Atmospheric Monitoring

Air Quality.

Background.

Air pollution knows no bounds. Regional haze and light pollution obscure scenic vistas at nearly every national park and wilderness area, and in some areas, air pollution can even be a health concern. Because atmospheric conditions affect everything from groundwater to soil, from flora and fauna to human health, Cape Cod National Seashore actively monitors air quality on the outer Cape.

Unlike stratospheric ozone, which forms naturally in the upper atmosphere and protects the earth from harmful ultraviolet rays, ground-level ozone is formed through a series of chemical reactions between manmade emissions of volatile organic compounds (VOCs) and nitrous oxides (NOx) in the presence of heat and sunlight. Largely a result of fossil fuel combustion in motor vehicles and power plants, these compounds are taken up into the atmosphere in large quantities when the wind blows across heavily populated and/or industrialized areas. Airborne, VOCs and NOx become capable of traveling long distances. Thus, although relatively few of these ozone-forming pollutants are actually produced on Cape Cod, CACO is the recipient of a "pool" of pollutants that forms over the industrialized Midwest and heavily populated Northeast corridor. From 1996-8, CACO ranked 7th of all national parks in daily maximum ozone concentration, and the entire Cape is presently classified as a "non-attainment area" of the EPA's National Ambient Air Quality Standards (NAAQS) for ground-level ozone. Human exposure to ozone at levels above the 0.08 ppm NAAQS can aggravate asthma, reduce lung function and cause temporary eye and throat irritation, with repeated exposure leading to more serious chronic health problems, such as cancer and respiratory illness. At much lower concentrations, it can also compromise the growth, reproduction and overall health of many plant species. It is believed that the effects of ground-level ozone on long-lived species accumulate over time, with the potential for adverse impacts on entire ecosystems and ecological functions, including water movement and nutrient cycling.

A major contributor to acidic deposition in the eastern United States, sulfur dioxide is also a concern at CACO. The risk of surface water acidification is considered high in CACO's poorly buffered ponds and vernal pools, and sulfur dioxide may combine with ozone to cause a very severe needle tip burn in some of the park's conifer populations.

CACO is a Class II area under the Clean Air Act and has been monitoring precipitation chemistry through the National Atmospheric Deposition Program (NADP) and Massachusetts Acid Rain Monitoring Project since 1981, and ambient ozone through the Washington Support Office Air Quality Division and Massachusetts Department of Environmental Protection (DEP) since 1987. Investigations of both historic and current kettle pond chemistry have been conducted; however, levels of ambient sulfur dioxide on the outer Cape have not yet been determined.

Air Quality, continued.

Research Needs.

Conduct NADP Monitoring: The ability to understand the toxicity, chemistry and transport of ubiquitous air contaminants requires a regional approach to monitoring, as established by the National Atmospheric Deposition Program/National Trends Network (NADP/NTN). The goal of the NADP/NTN, which has a site in Truro, is to build a database of high-quality weekly deposition observations from around the continent. Ambient air quality data is currently collected cooperatively by CACO and the Massachusetts DEP at the Truro site; continued monitoring is required in order to track long-term changes in air quality within the park and to evaluate the effectiveness of legislative measures addressed at improving air quality in the region.

Monitor Sulfur Dioxide: Sulfur dioxide monitoring needs to be undertaken at CACO's air quality monitoring site for at least three years in order to effectively determine the importance of sulfur dioxide as a contributory agent to acidic deposition within the seashore.

Monitor Fog and Marine Aerosol Deposition: Fog and marine aerosols may not only be an important source of moisture, but also of significant amounts of nitrate and sulfate. Investigations into the amount, rate and ecological effects of this deposition are needed.

Whenever possible, air quality inventory and monitoring efforts at CACO should be integrated into regional, national and global climate change programs.

(See related project description under "Mercury Contamination of Aquatic Environs" in the Aquatic Ecology chapter.)

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